Chelonia Limited

Cetacean Monitoring Systems

DeepC-POD User Guide

WWW.CHELONIA.CO.UK

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July 2011

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1 Introduction

This User Guide describes how to set up, deploy and retrieve data from your DeepC-POD.

C-PODs are fully automated, static, passive acoustic monitoring systems that detect porpoises, dolphins and other toothed whales by recognising the trains of echo-location clicks they make to detect their prey, orientate and interact.

C-PODs record the time of occurrence, centre frequency, intensity, duration, bandwidth and frequency trend of tonal clicks within the frequency range 20 kHz to 160 kHz. This allows them to monitor clicks from all odondocetes except sperm whales. Digitised sound is not stored.

The data are stored on a Secure Digital (SD) flash card and later analysed on a PC to identify the presence of cetaceans by detecting the trains of ultrasonic echo-location clicks they produce.

The ability of C-PODs to accept broadband clicks means that:

- different filter setting are unnecessary, making C-POD setup very simple
- logging is very uniform between different C-PODs within a project
- there is an opportunity to integrate data from different projects over wide geographical areas.

The C-POD characteristics and all the settings in use during logging are stored on the SD card. The settings can be viewed using the CPOD.exe software when a data file is open.

Help and support

We offer full email support with our C-PODs and will be pleased to help with queries on any aspect of C-POD use.

Your C-POD purchase also entitles you to free future software upgrades.

We offer a range of additional services, including data analysis and interpretation.

You can find more information and the latest software and documentation on our web site at www.chelonia.co.uk or by contacting us at the address below.

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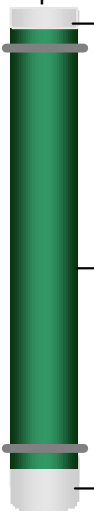
2 Checking parts

Once you have unpacked your DeepC-POD, check to make sure that you have all the correct parts:

DeepC-POD



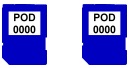
Lid

Contains the standard deployment battery pack, SD card and electronics

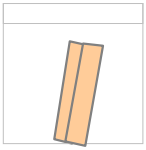
Houses the hydrophone

Battery pack connector spring

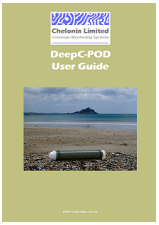
SD card reader



SD cards: one located in the SD card holder inside the POD and one spare



Silica gel



DeepC-POD User Guide

DeepC-POD

The DeepC-POD consists of an aluminium casing with hydrophone housing at one end and a removable lid at the other end.

DeepC-PODs are very robust, but be careful not to drop the C-POD or subject it to hard knocks, as this might disconnect power and cause loss of data.

PODs are identified by a unique number that is shown on labels on the SD cards and on the POD housing under the upper buffer ring.

Unlike the standard C-POD, the DeepC-POD is not buoyant.

Secure Digital (SD) cards

Two SD cards are supplied with each C-POD. On delivery, you will find one SD card in the POD's SD card holder and one in an SD card case.

SD cards are not interchangeable between C-PODs and are labelled with their correct C-POD number to help prevent them from being used in the wrong C-POD.

No setup is required; all the setup information for the C-POD is already stored on the SD card. When the C-POD is deployed, it writes click data to the card. On retrieval, you copy the data from the card by using a PC running the CPOD.exe software. When you retrieve a C-POD after deployment, you can replace the SD card with the spare and immediately redeploy the C-POD.

The SD cards have a LOCK switch on the side. The switch should always be in the unlocked (read) position as shown below. If it is moved to the locked position, the POD will not start.

Silica gel pack

The silica gel pack is used to prevent condensation on the inside of the DeepC-POD when it is deployed. Two packs are supplied for each POD, one for deployment and one spare.

There may be a risk of corrosion if there is no silica gel to keep the humidity low. Corrosion may cause power loss or failure of electronic components which may lead to data loss.

The silica gel pack slides down between the batteries and the POD housing.

Additional requirements

In order to run the CPOD software and download data from SD cards, you need a computer running Microsoft Windows 95, NT, 2000, XT, Server 2003, Vista or Windows 7.

Also, prior to deployment, if you choose to re-use batteries, it is recommended that you check their voltages using a voltmeter, to ensure that they are suitable for the period of deployment.

The section *Retrieving DeepC-PODs* on page 21 contains a recommended kit list for deploying and retrieving PODs.

3 Software installation

The installation procedure, described below, consists of downloading files from the Chelonia web site.

Tip: Visit the links below on a regular basis to check for updates and modification information.

Installing the software

Tip: The C-POD software is being developed and improved continuously. Make sure you have the latest version of the program as well as the software guides.

To install the C-POD software:

1. Create a folder called **CPOD** on your computer.
2. Go to the Chelonia C-POD downloads page at:
   http://www.chelonia.co.uk/cpod_downloads.htm
3. Download the following files to the new **CPOD** folder:
   - **CPOD.exe**
   - **C-POD.exe Quick guide.ppt**
   - **C-POD.exe Train Filter guide.ppt**
4. Create a subfolder for your data files, called **cpod data**.

Installation is complete.

Other files

You can also download the latest version of this User Guide from:

http://www.chelonia.co.uk/cpod_downloads.htm

Uninstalling the software

To uninstall the C-POD software:

1. Delete the **CPOD** folder, along with any other C-POD files.

4 Planning your deployments

This section contains advice and information to help you plan your deployments.

Calculating the maximum deployment time

Maximum deployment time is dependent upon the following factors:

- The capacity of the D-cells (usually specified in milliamp hours, mAh). Using two stacks of D-cells, each with a 15000 mAh capacity, the maximum deployment time is expected to be approximately 4 months.
- The capacity of the SD card.

Deployment environments are very variable and therefore you should consider carrying out preliminary tests of battery consumption and memory use at sea, before full deployment.

Lost and found

Write your contact details on the outside of the C-POD using indelible ink. Place a label inside the C-POD as well.

If you prefer not to write your contact details on the C-POD, the POD lid has the web site address **www.phonehome.org.uk** etched in the top.

This is a simple web site that will allow someone who finds a C-POD to contact us. We will then contact you to arrange its return.

Moorings

This section provides general information and guidelines that you should consider carefully when designing your moorings.

Design the mooring using a mixture of sinking ropes and buoyant ropes. Use sinking ropes so that no loops of cordage float at the surface to entangle propellers and buoyant ropes that do not lie on the bottom and suffer excessive abrasion.

Use knots or fixings that grip the C-POD mooring line loop so that there is no possibility of continual movement, creating noise that may fill the SD card. If you use a shackle you can tape this with sticky tape. Position the anti-chafing tube as shown above, to prevent the POD housing from wearing the mooring line. If the C-POD attachment rope becomes damaged, replacements are available from us.

Buoyancy

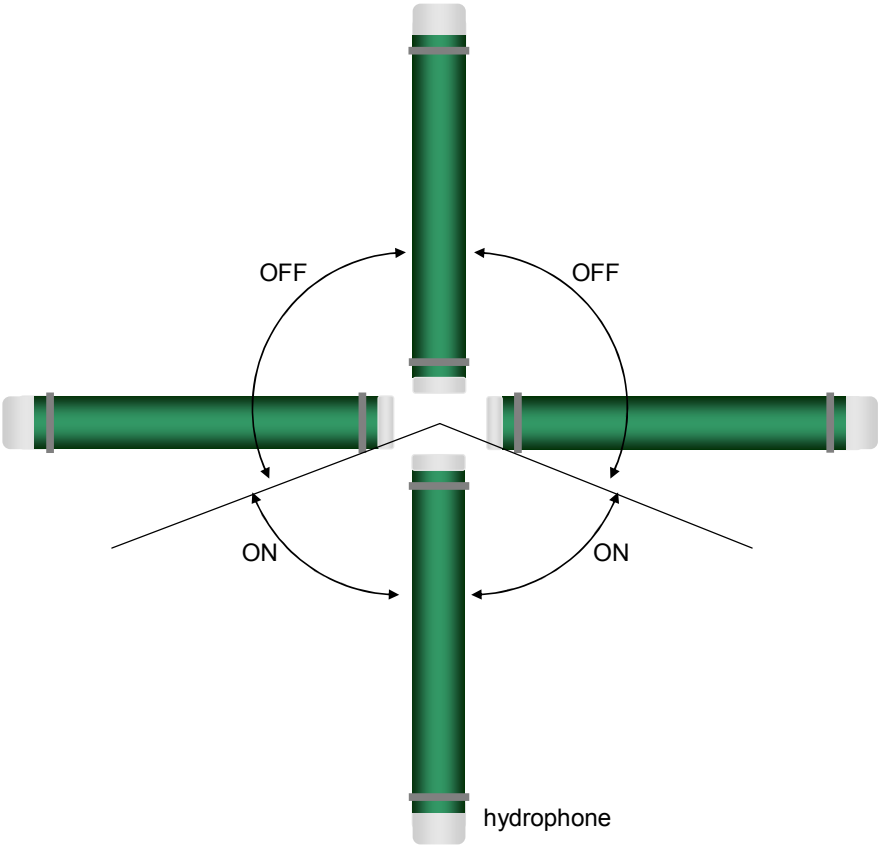
Unlike the standard C-POD, the DeepC-POD is not buoyant.

Attitude sensing

The DeepC-POD contains an attitude sensor which records the angle-from-vertical each minute.

The attitude can be viewed in CPOD.exe, when you have copied your data files after deployment, enabling you to ensure that the C-POD was correctly deployed in a vertical position.

The sensor is set to prevent logging until the DeepC-POD is deployed (when the hydrophone housing is pointing downwards). This allows the DeepC-POD to be set up and transported some time before deployment, saving power and memory.



Security

The main problems with moorings are theft, being moved by trawlers or storms and abrasion of lines.

Theft

This is a serious risk in many areas. Some possible solutions are suggested below:

- Get cooperation and advice from local fishermen, who may allow you to use their gear.
- Use a very small marker, for example, a single fishing float on a thin line that is only at the surface at low slack tide. The disadvantage is that it may wind itself around weed or anything else and sink.
- Do not use buoys. Use a line between two anchors that can be located via GPS using a grapple.
- Use pop-ups. These are commercially available acoustic releases. However, currently they are very expensive.
- Use C-links that dissolve after a set time in the water and then release a recovery buoy from the bottom.
- Use divers to deploy and recover your C-PODs.

Using anchors

A few concrete blocks are not adequate on a sandy sea bed as these are dynamic and move with tidal currents. Massive concrete anchors, digging metal anchors or heavy metal anchors are needed. Manhole covers with a central attachment are effective but can be hard to lift.

Buoys

Try to use the smallest buoy that you will be able to find on retrieval. This helps to minimises drag in storms. However, some users have deployed large surface markers with radar reflectors and 4 tonne anchors.

You might prefer to use a short line that results in the buoy spending most of the time submerged due to the tide stream or tide height, appearing only briefly at the surface when the tide is slack or at low water. However, make sure the float will not be collapsed by the water pressure.

Directionality

All C-PODs show lower sensitivity directly along the long axis of the housing, especially in the battery pack direction.

Towing the C-POD

Towing C-PODs is not normally recommended, for the following reasons:

- Animals are more or less undetectable unless they face the hydrophone.

- Porpoises tend to move away from moving boats and become undetectable over a width and distance that varies both with boat characteristics and with porpoise familiarity.
- Detection well beyond the range of responsive movement is unlikely with the C-POD so no undisturbed data set is available.
- Dolphins find towed C-PODs very interesting and will follow for long periods and get detected easily, but again the variables controlling this interaction are almost impossible to determine.

Towing a long way behind a yacht might give a usable way of filling weather-gaps in survey data for porpoises, and crude dolphin-encounter data.

5 Setting up DeepC-PODs for deployment

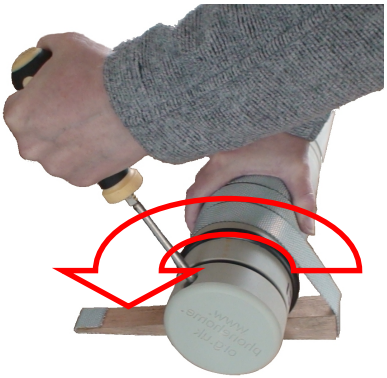
It is strongly recommended that before you deploy your PODs, you practice setup, starting, closing, opening and downloading data, as described in this section and sections 6 and 7, so that you are confident about the operating procedures.

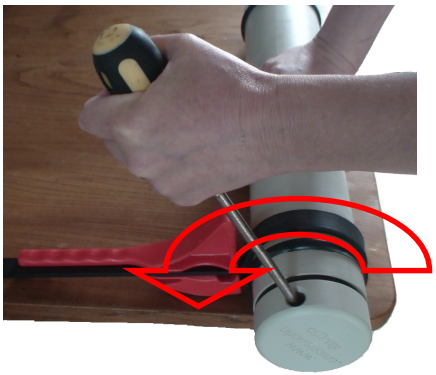
Tip: A link to brief videos showing how to start and stop the POD can be found on the Chelonia web site at::

http://www.chelonia.co.uk/cpod_downloads.htm

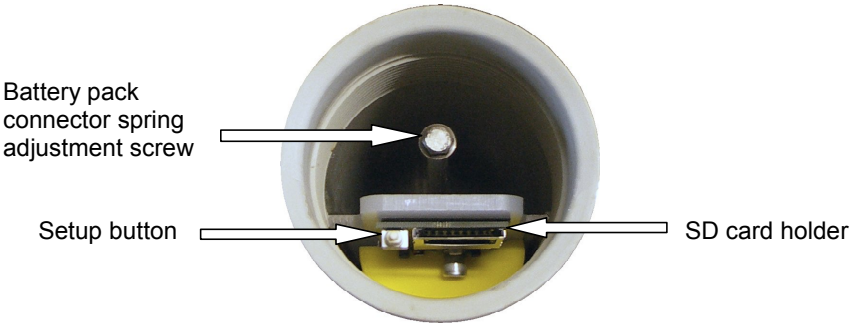
Opening the DeepC-POD for the first time

1. Use a wrench, like those shown below, to hold the C-POD body while using a heavy screwdriver or bar to twist the lid open.





Internal parts of the POD



Installing batteries

The C-POD battery pack holds 2 stacks of 5 D-cells, side-by-side in the POD housing, with the positive end of all cells facing inwards.

For most purposes, alkaline D-cells are recommended.

Rechargeable D-cells can be used, providing the voltage from each stack does not exceed 11 volts. However, the self-discharge rates and power density of most types of rechargeable D-cell means that running times are reduced below half.

The total voltage of each stack of cells must not exceed 11 volts. **Supply voltages above 11 volts will damage the C-POD irreversibly.**

A stack of Lithium D-cells **must not be used** – the voltage from four cells is too high and will damage the C-POD irreversibly. Two lithium D-cells and conducting 'blank cells' could be used, but the capacity advantage is minimal.

NiCad rechargeable batteries are not recommended as they have a high self-discharge rate so that the running time is shorter than you would expect from the capacity of the cell.

The C-POD uses one stack of D-cells at a time. The electronics selects the stack that provides the lower voltage. When the voltage from this stack of cells falls too low, it selects the other stack of cells automatically.

Deployment time using 10 D-cells is dependent upon the capacity of the D-cells and the acoustic conditions at sea.

To install the batteries:

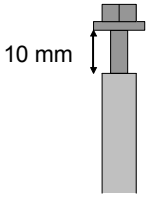
1. Inspect the batteries for damage. If the insulation around the outside casing of the battery is damaged, it can cause the battery pack to short-circuit. Either repair it with tape or use a new battery.
2. If you are re-using batteries, check the output voltage of each battery using a voltmeter.
3. Place the C-POD on a horizontal surface.
4. Slide the cells into the C-POD, one by one.

All the cells should face the same way – **positive end facing into the C-POD**.

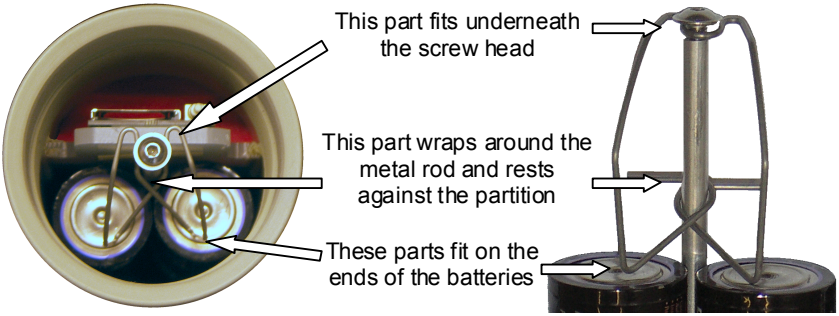
Starting the C-POD

Connect power

1. Loosen the battery pack connector spring adjustment screw that there is approximately 10 mm between the underside of the screw head and the rod. This should make it easier to fit the battery pack connector spring.

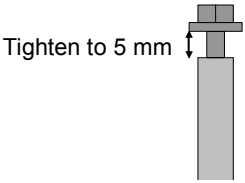


2. Fit the battery pack connector spring as shown below:


This part fits underneath the screw head
This part wraps around the metal rod and rests against the partition
These parts fit on the ends of the batteries

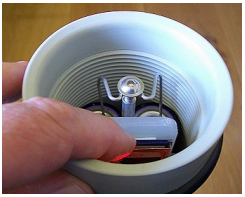
The power LED flashes rapidly (approximately 2 times a second) to indicate that power is connected.

3. Tighten the adjustment screw until there is approximately 5 mm between the underside of the screw head and the rod.

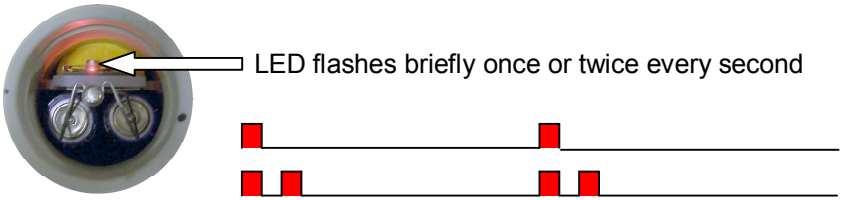


Insert the SD card

1. With the batteries inserted and power connected as described above, insert the SD card into the card holder in the C-POD and push it down *quickly but gently* until it locates in the card holder.



The power LED now gives either one or two short flashes per second, depending on which battery stack is being used.



If the power LED does not show the correct sequence of flashes, your C-POD may not be set up correctly. This can happen if you push the SD card in too slowly. If this happens:

Remove the SD card and disconnect the power for at least 4 minutes to ensure that the POD electronics are reset. Then reconnect the power and reinsert the SD card.

Do not simply remove and reinsert the SD card as the POD will not start properly and this may lead to data loss.

Start the POD

The C-POD has an accurate timer but no knowledge of the date or time. In order to have accurate times and dates in your data, **you must record the date and time that you start the C-POD**.

1. Install the batteries, connect power and insert the SD card as described above and make sure that the LED is flashing briefly once or twice every second.
2. Make sure that you or someone else is ready to note down the date and exact time.
3. Hold down the setup button about 15 seconds before the end of the clock minute.

The C-POD now reads the setup file on the SD card and then the LED stays on until you release the button.

4. Release the button exactly on the end of the minute **and note the date and exact time**.

   The LED flashes briefly a few times and then gives one very short single flash every few seconds.

   The C-POD starts recording its angle-to-vertical and the ambient temperature each minute.

The C-POD will not start logging until the hydrophone is lower than the lid. This allows you to transport the POD without wasting battery power and memory space. When the C-POD is deployed in the sea, it should vertical, hydrophone housing downwards, and will start logging automatically (see *Buoyancy* on page 10 and *Attitude sensing* on page 11).

Tip: Write down the date and time and keep it safe. You can enter the date and time into CPOD.exe when you copy your data onto your PC after deployment and it will be incorporated into the data file.

Setup summary

The set-up sequence is summarised below:

1. **Disconnect the C-POD for at least 4 minutes to reset the electronics.**
2. Connect the power.

3. Insert the SD card into the holder and press it down *quickly but gently*.

4. Press/hold/release the setup button and note the start date and exact time.

When the C-POD is deployed vertically, hydrophone down, it will start logging.

If the power LED does not show the correct sequence of flashes, your C-POD may not be set up correctly. Remove the SD card and disconnect the power **for at least 4 minutes** to ensure that the POD electronics are reset. Then reconnect the power and reinsert the SD card.

Tip: A link to brief videos showing how to start and stop the POD can be found on the Chelonia web site at::

http://www.chelonia.co.uk/cpod_downloads.htm

Tip: If your POD fails to start correctly, refer to section *10 Troubleshooting* on page 30.

Closing the DeepC-POD

The C-POD lid is supplied with two O-rings. The O-rings have been lightly lubricated using a dry-lube oil to ensure that the lid tightens smoothly.

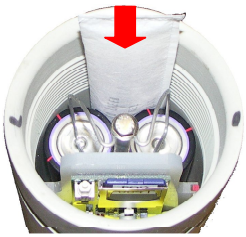
Tip: If you want to lubricate the O-rings before deployment, using a dry-lube lubricant minimises wetness and stickiness that might attract dust and grit.

To close the POD:

1. Make sure there are two O-rings in place on the lid.

   Check that the O-rings are clean. Check particularly that there are no hairs, grit or sand trapped beneath the O-rings as these could cause damaging leaks.

2. Take a silica gel packet out of its moisture-proof container and slide it down **between the batteries and the POD housing**.



   There may be a risk of corrosion if there is no silica gel to keep the humidity low. Corrosion may cause power loss or failure of electronic components which may lead to data loss.

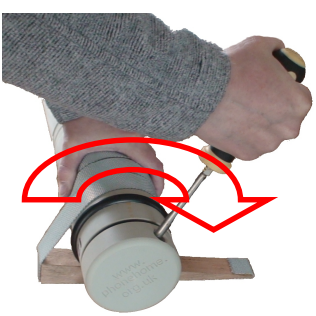
   The silica gel pack can become saturated in only 30 minutes of exposure to warm damp air, so keep it in an airtight jar or bag until you are ready to close the C-POD.

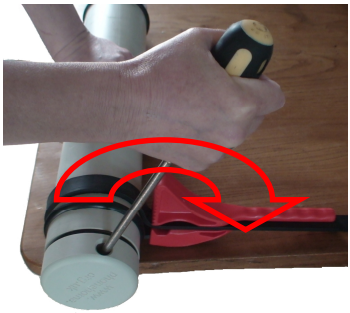
   When dry, silica gel is yellow/orange in colour. The crystals turn green when damp.

   To restore the crystals, place the bag in an electric oven and heat at 120°C for two hours.

3. Align the lid and C-POD housing carefully and begin screwing them together.

4. Screw the C-POD and lid together tightly ensuring that the visible O-ring is compressed.





   The C-POD is now ready for deployment.

5. When the POD is ready for deployment – that is, running with lid tightly screwed on – carefully weigh the POD and note the value.

   Weighing the DeepC-POD before deployment is essential as it will allow you to compare the weight after deployment to ensure that water has not leaked into the POD, pressurising the contents.

The C-POD is recording its angle to vertical and the temperature, but will not start logging if it is kept horizontal. The DeepC-POD is set up to start logging automatically when it is deployed vertically, hydrophone housing downwards (see *Buoyancy* on page 10 and *Attitude sensing* on page 11).

6 Retrieving DeepC-PODs

It is recommended that you take the following kit with you when you retrieve C-PODs at sea:

- the weight of the DeepC-POD before deployment
- the spare SD card
- a watch, to note the exact time of retrieval and redeployment
- a scrubber and scraper to remove bio-fouling
- a heavy screwdriver and C-POD wrench to open and close the C-POD
- a towel
- a pair of tweezers to remove the silica gel
- an airtight container to put the silica gel in
- paper towels to clean any sand or grit that may have lodged under the O-rings
- a spare set of O-rings in case of damage
- the spare battery pack connector spring
- new batteries for redeployment
- a voltmeter to check battery condition, if you want to re-use batteries
- a waterproof marker pen to write contact details on the C-POD housing
- any tools for your attachment method
- a splash-proof box for this kit

Tip: When you retrieve the DeepC-POD, it will continue to log while the hydrophone housing is lower than the lid. If you are not opening the POD immediately, store it horizontally to save power and memory. In this position, it logs only its angle to vertical and ambient temperature.

Opening the DeepC-POD after deployment

WARNING: BECAUSE THE DEEPC-POD CAN BE DEPLOYED AT GREAT DEPTH, ANY LEAKAGE OF SEAWATER INTO THE POD CAN CAUSE THE AIR INSIDE TO BECOME COMPRESSED. IF THIS HAPPENS, SIMPLY UNSCREWING THE LID MAY CAUSE AN EXPLOSIVE RELEASE OF AIR.

It is therefore important that you follow the procedure below to firstly assess whether water has entered the POD and if so, how you should proceed.

When you retrieve a DeepC-POD:

1. Use a plastic scraper to clean off any heavy fouling.

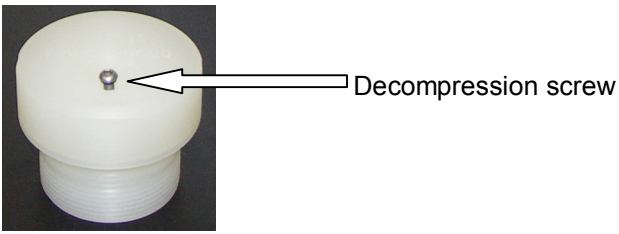
2. Scrub and wash the C-POD housing.
3. Dry the C-POD and lid, especially around the O-ring.
4. **BEFORE YOU OPEN THE POD**, carefully weigh it and compare the two values – before and after deployment.

   If the weights are the same, you can safely open the lid.

   If the POD is heavier, water has seeped in and the contents will now be under pressure. Follow the procedure below.

If the POD is heavier after deployment

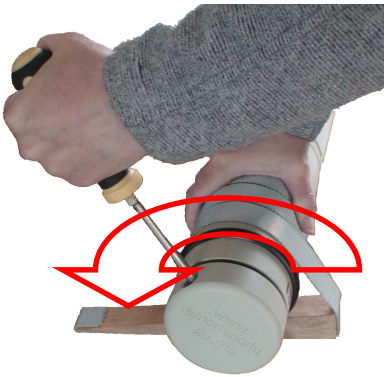
1. Remove the **plastic plug** over the decompression screw in the POD lid.
2. **Carefully unscrew the decompression screw to release the compressed air. If possible, do this under water, to minimise the effects of the compressed air when it is released.**

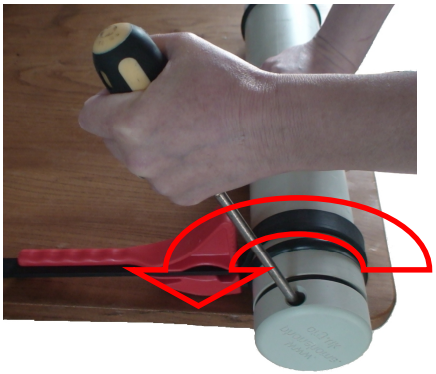


Stopping the DeepC-POD and retrieving the SD card

When you are sure that the POD is not pressurized and is safe to open:

1. Unscrew the C-POD lid in a dry, stable location. Use a wrench, like those shown below, to hold the C-POD body while using a heavy screwdriver or bar to twist the lid open.





Tip: If you didn't note the start date and time and the power LED is still flashing you can record the end time and that can be used to give data files a ±1 minute accuracy.

2. Press and hold down the setup button until the power LED lights.
3. As soon as the LED lights, you can release the setup button.

   The C-POD stops recording and the LED stays on briefly while the POD writes a data summary on the SD card.
4. Remove the SD card by pressing down gently on the card and then allowing it to spring up.
5. Store the SD card safely – it contains all your data.
6. Remove the battery pack connector spring.
7. Remove the silica gel and put it in a moisture-proof container.

If the granules look blue/green it means that they have become wet. To restore the crystals, place the bag in an electric oven and heat at 120°C for two hours.

8. Inspect the O-rings for damage and replace them if necessary.
9. If the C-POD is not going to be used again soon, remove the batteries.

Tip: If you disconnect the batteries before recording the data summary, your data files will not be damaged and can still be copied from the SD card using CPOD.exe. However, you will not be able to view the summary data before you copy the files (see section *7 Downloading your data* on page 25).

Redeploying the DeepC-POD immediately

If you want to redeploy the DeepC-POD immediately:

1. Remove the battery pack connector spring, silica gel and batteries.
2. If you want to re-use the batteries, use a voltmeter to check their suitability.
3. Insert new batteries or re-insert the old ones if they are suitable.
4. Insert the battery pack connector spring. Observe that the power LED flashes rapidly on and off.
5. Insert your spare SD card and press in down *quickly but gently* to locate it in the holder. Observe that the power LED gives either one or two short flashes per second, depending on which battery stack is being used.

Any data on the SD card will be overwritten when you start the C-POD.

6. Insert the silica gel pack between the battery stacks and the POD housing.
7. Press and hold down the setup button until the C-POD power LED goes out and comes on again.
8. Release the button and note the date and exact time.
9. Observe that the power LED is flashing once very briefly every five seconds.
10. Close the C-POD.
11. Carefully weigh the POD and note the value.

7 Downloading your data

When you have retrieved your SD card from a deployed C-POD, you can read the data using the CPOD.exe software.

Do not format the SD card, or write any files on to it. The SD card uses a special format which you can read only by using CPOD.exe. **If you use any other application to write to the SD card it will become unusable and any data on it will be lost.**

The CPOD.exe software has a Summary feature that allows you to check the data on the SD card quickly, so that you can make a decision about whether to redeploy the C-POD or spend time downloading the data files and analysing them.

The files are on the SD card are:

DATA0.CHE, DATA1.CHE etc, – the data files, each of about 1 GB

SETUP.CHE – a very small file containing configuration details

After an SD card has been read into a PC it can be put back into a C-POD for redeployment. Any new data will overwrite the old data on the card.

Connecting the SD card to a PC

To set up your SD card:

1. Insert the SD card into the SD card adaptor.
2. Insert the adaptor into a USB port on your computer.

   Your PC will detect the SD card automatically and identify it as a removable drive.
3. If your PC prompts you to open the new drive using Windows Explorer, minimize the Windows Explorer window without selecting an option.

Running the CPOD.EXE software

In the CPOD folder:

1. Run **CPOD.exe**. The main window is displayed.
2. To display and hide menu options, move the mouse cursor up and down through the blue bar at the top of the CPOD.exe window.
3. Display the menu options.
4. Click on the **Read SD** tab.

Viewing summary data

To view a summary of the data of the SD card before it is copied:

1. Click the **Show summary from file DATA0.CHE** button.
2. Locate the SD card with the volume name CHELONIA and open the file DATA0.CHE. A brief summary of the data is displayed.

   You can use this summary to decide whether to copy the data to your PC now (large amounts of data can take a long time to copy) or wait until a more suitable time.

Copying the data

The date, time and location data that you enter below are important – do not skip the steps.

To copy data from a C-POD SD card:

1. In the **Read SD** tab, enter the time the POD was started.

   The date and time will be added to the data in the file when it is copied to your PC.
2. Enter location and date information that CPOD.exe will use to append to the data file name.
3. Enter any deployment information that you want added to the data file.
4. Check or clear the **open file when finished** box.
5. To copy the data from the SD card to your PC, click **Read SD card**.
6. Locate the SD card, select the data file DATA0.CHE and click **Open**.

   CPOD.exe suggests a name for the data file, based on the parameters you entered above. You can simply accept the default name or change it.
7. Locate the **cpod data** folder where you should store your C-POD data files and click **Save**.

   CPOD.exe copies each .CHE file that contains data and creates corresponding data files (.cp1). If more than one data file is downloaded, file001, file002, etc., is added to the file names.

Tip: If you need to stop the data transfer, click on the **Stop data transfer** button.

Tip: When you have copied and safely stored the data from the SD card, you can reuse the card immediately – it does not need to be set up as the C-POD setup information is retained on the card. Any data on the SD card will simply be overwritten by the C-POD when it is deployed.

8 Analysing your data

The CPOD software allows you to view, analyze and export your data. It includes automatic click train detection which we will continue to develop as more data becomes available.

This path of developing software, which can be used on all collected data, has been successfully followed in the C-POD's predecessor, the T-POD. However, the T-POD software is not able to analyse data from the C-POD as the C-POD logs many more click features.

The provision of a single method for use in a wide range of projects is a key aim in the development of the C-POD.

We would like to use customer C-POD data to help us improve the accuracy and sensitivity of the C-POD PC software train filter and species identification. Any software improvements we make will always be retrospectively applicable to all data sets and new versions of the C-POD software will be available free of charge, so that you can re-analyse your data.

If you send us a copy of your C-POD data, we will, in return, provide brief feedback on the quality of your datasets free of charge. Any data you send us will be kept in complete confidence.

You can send your data to us by email, via a file transfer service (such as YouSendIt), post an SD card or copy the data files onto a CD-ROM or DVD. See our contact details on page 6.

For an introduction to analysing your data, download and read the software guides on the Chelonia web site (see *Installing the software* on page 9).

9 Maintenance

Cleaning

Use a scrubbing brush to remove all marine growth and dirt completely. Wash and dry the C-POD.

O-rings

O-rings must be clean of all contamination – especially hairs and grit – before you close the C-POD. Any dirt on the O-rings may cause water to leak into the C-POD housing, causing damage to the electronics and loss of data.

Whenever you open the C-POD, follow the guidelines below:

- Place the C-POD housing on a clean hard surface.
- Look to see if there is any water between the outer and inner O-rings when the C-POD is opened.
- If an O-ring has picked up particles, remove it using a blunt tool like the end of a small spoon.
- Carefully clean all surfaces.
- If you are in any doubt about the state of the O-rings, replace them with new ones. A spare set of O-rings is supplied with new C-PODs. Replacements are available from Chelonia Limited.

Transducer housing

Bio-fouling or contamination with grease or paint can be removed using the kind of non-abrasive pads and preparations used for cleaning cooking utensils.

Mooring lines

Inspect the mooring lines after every deployment for signs of wear – mainly abrasion against rough surfaces.

Electronics

Do not connect batteries or other DC power supplies above 11 volts. **Supply voltages above 11 volts will damage the C-POD irreversibly.**

Silica Gel

Silica gel packs should be inserted into the C-POD to absorb any water vapour and keep the electronics dry.

When you remove a silica gel pack after opening a C-POD, put it immediately into an airtight container.

When dry, silica gel is yellow/orange in colour. The crystals turn green when damp.

To restore the crystals, place the bag in an electric oven and heat at 120°C for two hours.

There may be a risk of corrosion if there is no silica gel to keep the humidity low. Corrosion may cause power loss or failure of electronic components which may lead to data loss.

Storage

Before you store your C-PODs:

- Remove all batteries.
- Clean off all barnacles and other marine encrustations.
- Wash the outside of the POD housing and any mooring lines using fresh water.

If you are storing C-PODs in a dry place, leave them open.

If you are storing C-PODs in a damp place, store them closed, with active silica gel packs inside.

10 Troubleshooting

When I deployed the POD, I forgot to write down the date and time.

- When you recover the POD, if the power LED is still flashing, you can record the end date and time and that can be used to give data files a ±1 minute accuracy.

When I connect power, the power LED does not light.

- **Batteries inserted incorrectly:** Check that the batteries are inserted correctly – positive end facing into the C-POD, negative towards the connector.
- **Battery voltages too low:** Check the battery voltages. The C-POD requires at least 4 volts in order to run.
- **Batteries damaged:** Check the battery casings for damage to their insulation – breaks in the insulation can cause shorting. Also check for leakage.
- **C-POD electronics have not reset:** Disconnect the power for at least 4 minutes.

When I connect power and insert the SD card, the power LED continues to flash on and off, instead of giving either one or two short flashes per second.

- **You inserted the SD card too slowly, so the POD electronics could not set up the card correctly:** Remove the SD card, disconnect the batteries, and wait at least 4 minutes. Then start the setup procedure again (see *Starting the C-POD* on page 16). When you insert the SD card, push in down *quickly but gently* to locate it in the holder.
- **The POD electronics have not been discharged and reset:** Remove the SD card, disconnect the batteries, and wait 4 minutes. Then start the setup procedure again (see *Starting the C-POD* on page 16).
- **The Lock button on the SD card has moved to the locked (read-only) position:** Move the Lock button to the unlocked (read) position (see *Secure Digital (SD) cards* on page 8). Then start the setup procedure again (see *Starting the C-POD* on page 16).
- **The SD card is damaged:** Start the setup process again, using the spare SD card. Please contact us for a new SD card.
- **The SD card holder is damaged:** Try the spare SD card. If this does not work either, check that the cards are locating in the holder correctly. Please contact us for return and repair.

When I opened the C-POD after deployment, the power LED was off.

- **Batteries exhausted:** When battery voltage drops too low, the C-POD writes a data summary to the SD card and shuts down automatically. Your data and summary files will be intact. You can copy them to your PC in the normal way, using CPOD.exe (see *Downloading your data* on page 25).
- **Battery power failed suddenly:** The C-POD may not have been able to write a data summary. However, any data recorded up until the power failed will be intact. You can copy the data files to your PC in the normal way, using CPOD.exe, but you will not be able to view summary information first (see *Downloading your data* on page 25).
- **Corrosion of battery contacts:** The positive terminal battery contacts can suffer from corrosion if they become damp. This can cause a loss of power and data. A tool to clean the contacts is available free-of-charge from Chelonia.

After deployment, I accidentally disconnected power before writing a summary to the SD card.

- Your data files will not be damaged. You can still copy them to your PC using CPOD.exe, but you will not be able to view summary information first (see *Downloading your data* on page 25).

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